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Vapor Pressure Distribution of Selected Organic Chemicals

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The objective of this project was to prepare a consistent tabulation of physical property data for selected organic chemicals, for use by the Emission Standards and Engineering Division of EPA's Office of Air Quality Planning and Standards. The data reported for 450 organic chemicals are melting point, boiling point, physical state at 20°C, and vapor pressure at 20°C and 101.3 kPa. These data were derived from standard references or estimated using widely accepted techniques. Additionally, physical state and vapor pressure distributions were prepared.

The 450 chemicals covered in this report generally represent high-volume industrial organic chemicals.

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February 1981

VAPOR PRESSURE DISTRIBUTION OF SELECTED ORGANIC CHEMICALS

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FOREWORD

When energy and material resources are extracted, processed, converted and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory-Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report, "Vapor Pressure Distribution of Selected Organic Chemicals," was written to support regulations on volatile organic compound (VOC) emissions which are under development by EPA's Office of Air Quality Planning and Standards. It provides a catalog of physical property data, particularly vapor pressures, on 450 organic chemicals. The vapor pressures are tabulated at standard conditions of 20°C and 101.3 kPa. The values reported are based on widely accepted and reasonably accurate estimation methods.

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ABSTRACT

The objective of this project was to prepare a consistent tabulation of physical property data for organic chemicals for use by the Emission Standards and Engineering Division of EPA's Office of Air Quality Planning and Standards. The data reported for 450 selected organic chemicals are melting point, boiling point, physical state at 20°C, and vapor pressure at 20°C and 101.3 kPa where available. From these data, physical state and vapor pressure summaries and distributions were prepared.

The 450 chemicals covered in this report generally represent high-volume industrial organic chemicals.

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SECTION 1

INTRODUCTION

EPA's Office of Air Quality Planning and Standards, Emission Standards and Engineering Division (ESED), is currently developing regulations for the control of fugitive volatile organic compound (VOC) emissions from organic chemical production facilities. Studies of emissions from these sources indicate that emission rates are correlated with the vapor pressure of the organic material in the system. In general, equipment in gas service contributes more to the total emissions than equipment in liquid service. Further, equipment in liquid service handling relatively volatile material contributes more to the total problem than equipment containing chemicals with low volatility. Therefore, it is important to have a quantitative assessment of the vapor pressure distribution of chemicals potentially covered by EPA regulations.

As a result, the Emission Standards and Engineering Division requested the Organic and Inorganic Chemicals and Products Branch of the Industrial Environmental Research Laboratory in Cincinnati to prepare a consistent tabulation of vapor pressures for organic chemical products currently considered for inclusion in fugitive emissions regulations. This special report presents the results of this analysis.

For each of the 378 chemicals (or groups of chemicals) identified by the Emission Standards and Engineering Division, the following data have been collected: (a) physical state at 20°C and 101.3 kPa (1 atmosphere); (b) vapor pressure at the same conditions of temperature and pressure; and (c) references for each vapor pressure. From these data, physical state and vapor pressure summaries and distributions have been prepared. Data used in preparing these summaries is presented in tabular form in Appendix A.

Finally, it is important to note that the vapor pressure data presented herein do not represent experimentally determined values at 20°C and 101.3 kPa. Rather, they are estimates developed from primary references for the purpose of generating reasonable vapor pressure distributions using the most widely accepted and accurate methods. The various estimation methods are briefly described in Section 2.

SECTION 2

ESTIMATION METHODS

Most of the vapor pressures were estimated with one of several variations of the Antoine Equation, depending on the specific reference. Other references which report data at 20°C were also used on occasion. It must be pointed out that for many chemicals, especially solids, 20°C is outside the temperature range at which the reported coefficients apply. This is noted in the Appendix A Vapor Pressure Table by an asterisk in the CODE column. Use of these reported coefficients, for lack of better sources, can introduce considerable error in the estimate.

The specific equations generally used are summarized below, by reference.

2.1 Reference 2 (Handbook of Chemistry and Physics, 54th Edition)

Vapor pressures were calculated with the equation from Page D-162:

$$\log_{10} P = (-0.2185\ A/K) + B$$

where

P = vapor pressure, torrs (mm. of Hg)
K = temperature in °K
A, B = constants for each chemical

2.2 Reference 7 (Lange's Handbook of Chemistry, 12th Edition)

Vapor pressures were calculated with the equation from Page 10-28:

$$\log_{10} P = A - \frac{B}{t+C}$$

where

P = vapor pressure, mm Hg.
t = temperature in °C
A, B, C = constants for each chemical

2.3 Reference 10 (Pressure-Volume-Temperature Relationships of Organic Compounds)

Vapor pressures were computed as a function of boiling point.

2.4 Reference 20 ("Vapor Pressure of Pure Substances")

Based on the given data, a linear regression equation was developed. This equation was then used to calculate the vapor pressure at 20°C.

SECTION 3

VAPOR PRESSURE DISTRIBUTION

This section presents a summary of the physical state and vapor pressure information collected for the 378 organic chemical products (or chemical groups) provided by ESED. All of the data are based on the following "standard" conditions: 20°C and 101.3 kPa (1 atmosphere). For those entries of the 378 which are actually groups of chemical products, attempts were made to identify several specific chemicals in the group. This resulted in a total of 450 discrete chemicals.

Table 3.1 summarizes the information on the physical state of the 450 chemicals at the defined conditions:

Table 3.1

PHYSICAL STATE

	Number of Chemicals	Percent of Total
gases	26	6
liquids	269	60
solids	154	34
unknown	1	0.2
TOTAL	450	

The physical state was unavailable in readily accessible literature for one chemical, glycerol tri(polyoxypropylene)ether. Six percent of the chemicals are gases, sixty percent are liquids, and thirty-four percent are solids.

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APPENDIX A

PHYSICAL STATE AND VAPOR PRESSURE DATA

PHYSICAL STATE AND VAPOR PRESSURE DATA

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
20	Acetal	liquid	---	123.5	1	2.7	2,3	
30	Acetaldehyde	liquid	-123.5	21.0	4	98.6	5	
40	Acetaldol	liquid	---	83.0	4	<0.01	5	
50	Acetamide	solid	81.0	222.0	4	0.01	2,3	*
65	Acetanilide	solid	114.0	304.5	4	<0.01	2,3	*
70	Acetic acid	liquid	16.6	117.9	1	1.6	2,3	
80	Acetic anhydride	liquid	-73.0	139.0	4	0.4	2,3	
90	Acetone	liquid	-94.0	56.5	4	21.5	2,3	
100	Acetone cyanohydrin	liquid	-19.0	95.0	4	0.1	6	*
110	Acetonitrile	liquid	-45.0	81.6	4	9.4	2,3	
120	Acetophenone	solid	20.5	202.0	4	0.05	2,3	*
125	Acetyl chloride	liquid	-112.0	52.0	4	31.2	7	
130	Acetylene	gas	-81.0	---	4	---	---	
140	Acrolein	liquid	-88.0	52.5	4	29.7	2,3	
150	Acrylamide	solid	84.5	---	4	NA		
160	Acrylic acid & esters							
	(a) Acrylic acid	liquid	14.0	141.0	4	0.4	2,3,5	
	(b) Methyl acrylate	liquid	<-75.0	80.5	1	8.7	5	
170	Acrylonitrile	liquid	-83.6	77.3	4	11.4	2,3	
180	Adipic acid	solid	152.0	337.5	4	<0.1	2	
185	Adiponitrile	liquid	1.0	295.0	1	NA		

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
190	Alkyl naphthalenes							
	(a) 1,4-dimethylnaphthalene	liquid	7.7	268.0	1	<0.01	7	
	(b) 1,6-dimethylnaphthalene	liquid	-14.0	263.0	8	<0.01	7	
	(c) 1,7-dimethylnaphthalene	liquid	-13.0	263.0	8	<0.01	7	
	(d) 1,3-dimethylnaphthalene	solid	229.0	263.0	9	0.01	7	
	(e) 1,8-dimethylnaphthalene	solid	65.0	270.0	8	<0.01	7	*
	(f) 2,3-dimethylnaphthalene	solid	105.0	268.0	1	<0.01	7	
	(g) 2,6-dimethylnaphthalene	solid	109.0	262.0	9	<0.01	7	
	(h) 2,7-dimethylnaphthalene	solid	98.0	263.0	8	<0.01	7	
	(i) 1-methylnaphthalene	liquid	-22.0	244.6	1	<0.01	7	*
	(j) 2-methylnaphthalene	solid	34.6	241.1	1	0.01	7	*
200	Allyl alcohol	liquid	-50.0	96.5	4	2.4	2,3	
210	Allyl chloride	liquid	-134.5	44.5	4	40.8	2,3	
220	p-aminobenzoic acid	solid	187.0	---	7	NA		
	m-aminobenzoic acid	solid	174.0	---	7	NA		
	o-aminobenzoic acid	solid	145	---	7	NA		
230	Aminoethylethanolamine	liquid	---	239.0	1	<0.01	5	
235	p-aminophenol	solid	186.5	subl.	1	0.01	4	*
240	Amyl acetate	liquid	-70.8	149.3	1	0.5	2,3	
250	Amyl alcohol, n-	liquid	-79.0	137.5	4	0.3	2,3	
260	Amyl amine	liquid	-55.0	104.0	4	2.0	10	
270	Amyl chloride	liquid	-99.0	107.8	4	2.2	10	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
280	Amyl mercaptans							
	(a) 1-pentanethiol	liquid	-75.7	123.5	1,4	1.5	7	
	(b) 2-methyl-2-butanethiol	liquid	---	107.0	1	5.0	7	
	(c) 2-methyl-1-butanethiol	liquid	---	118.2	1	2.0	7	
	(d) 3-methyl-1-butanethiol	liquid	---	118.0	1	2.1	7	
290	o-sec-amyl phenol	liquid	0	242.5	1	<0.01	2	*
	p-tert-amyl phenol	solid	93	266	5			
300	Aniline	liquid	-6.3	184.1	1	0.1	2,3	*
310	Aniline hydrochloride	solid	198.0	245.0	1	4.0	6	*
320	m-anisidine	liquid	<10	251	4	0.01	2	*
	o-anisidine	liquid	5	225	4	0.01	2	
	p-anisidine	solid	57	246	4	NA		
330	Anisole	liquid	-37.5	155.0	1	0.3	2	
340	Anthranilic acid	solid	146.5	subl.	1	NA		
350	Anthraquinone	solid	286.0	377.0	4	<0.01	2	*
360	Benzaldehyde	liquid	-56.5	179.0	4	0.1	2,3	*
370	Benzamide	solid	130.0	288.0	4	NA		
380	Benzene	liquid	5.5	80.1	4	7.7	2,3,11	
390	Benzenedisulfonic acid	solid	120	---	12	NA		
400	Benzenesulfonic acid	solid	65.5	---	2	NA		
410	Benzil	solid	95.0	347.0	1	<0.01	2	*

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
420	Benzilic acid	solid	151.0	180.0	2	0.04	10	
430	Benzoic acid	solid	122.4	249.0	1	<0.01	2	*
440	Benzoin	solid	133.5	---	1	<0.01	2	*
450	Benzonitrile	liquid	-12.8	190.7	4	0.1	2,3	*
460	Benzophenone	solid	48.5	305.4	4	<0.01	2	*
480	Benzotrichloride	liquid	-5.0	220.8	4	0.03	2	*
490	Benzoyl chloride	liquid	-1.0	197.2	4	0.1	2	*
500	Benzyl alcohol	liquid	-15.2	204.7	4	0.01	2	*
510	Benzyl amine	liquid	---	185.0	1	0.1	2,3	*
520	Benzyl benzoate	solid	21.0	323.5	4	0.5	6	*
530	Benzyl chloride	liquid	-45.5	197.0	4	0.1	2,3	*
540	Benzyl dichloride	liquid	-16.4	205.2	1	0.1	2	*
550	Biphenyl	solid	71.0	255.9	1	0.01	2	*
560	Bisphenol A	solid	152.5	220	13	<0.01	2	*
570	Bromobenzene	liquid	-30.6	156.2	4	0.4	2,3	
580	1-bromonaphthalene	liquid	6.2	281.1	4	<0.01	2,7	
	2-bromonaphthalene	solid	55.0	251.5	4	NA		
590	Butadiene	gas	---	-4.5	4	---	---	
592	1-butene	gas	---	-6.5	4	---	---	
600	n-butyl acetate	liquid	-77.0	125.5	4	1.2	5	
630	n-butyl acrylate	liquid	-64.6	147.0	1	0.5	2,3,5	
640	n-butyl alcohol	liquid	-90.0	117.5	4	0.8	2,3	
650	s-butyl alcohol	liquid	-114.7	99.5	4	1.7	2,3	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
660	t-butyl alcohol	solid	25.6	72.4	4	3.6	2,3	
670	n-butylamine	liquid	-50.0	78.0	4	9.5	14	
680	s-butylamine	liquid	-104.0	63.0	4	9.5	14	
690	t-butylamine	liquid	-72.7	45.0	4	13.9	2,3	
700	p-tert-butylbenzoic acid	solid	165.0	---	1	NA		
710	1,3-butylene glycol	liquid	---	207.5	1	0.01	5	
750	n-butyraldehyde	liquid	-99.0	74.8	4	12.2	5	
760	Butyric acid	liquid	-7.9	163.5	4	0.1	2,3,5	
770	Butyric anhydride	liquid	-75.0	200.4	4	0.04	5	
780	Butyronitrile	liquid	-112.0	117.5	4	1.9	2,3	
785	Caprolactam	solid	70.0	139.0	1	<0.4	5	
790	Carbon disulfide	liquid	-111.6	46.5	4	37.0	2	
800	Carbon tetrabromide	solid	90.5	189.5	1	0.1	2	*
810	Carbon tetrachloride	liquid	-23.0	76.7	4	8.4	2,3,5	
820	Cellulose acetate	solid	---	---		NA		
840	Chloroacetic acid	solid	61.2	189.5	15	0.03	2,3	*
850	m-Chloroaniline	liquid	-10.4	230.5	4	0.01	2	*
860	o-chloroaniline	liquid	-1.9	208.8	4	0.03	2	*
870	p-chloroaniline	solid	72.5	232.0	4	0.01	2	*
880	o-chlorobenzaldehyde	liquid	12.4	211.9	1	0.03	8	*
890	Chlorobenzene (mono)	liquid	-45.0	131.5	4	1.2	2,3	
900	o-chlorobenzoic acid	solid	142	---	1	NA		
	m-chlorobenzoic acid	solid	158	---	1	NA		
	p-chlorobenzoic acid	solid	243	---	1	NA		

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
905	Chlorobenzotrichloride							
	(a) o-chlorobenzotrichloride	solid	30.0	264.3	1	<0.01	8	
	(b) p-Chlorobenzotrichloride	liquid	3.8	257.0	5	<0.01	10	
910	Chlorobenzoyl chloride	liquid	---	225	7	2.6	6	*
920	Chlorodifluoroethane	gas	---	-9.2	5	---	---	
921	Chlorodifluoromethane	gas	---	-40.8	1	---	---	
930	Chloroform	liquid	-63.5	61.5	4	18.6	2,3	
940	Chloronaphthalene (mono)	liquid	1:-2.5	259.3	4	<0.01	2	
		solid	2:59.5	256				
950	o-chloronitrobenzene	solid	32.5	245.5	4	<0.01	10	
951	p-chloronitrobenzene	solid	83.0	242.0	4	<0.01	10	
960	Chlorophenols							
	(a) o-chlorophenol	liquid	9.3	175.0	4	0.3	2,3	
	(b) p-chlorophenol	solid	43.5	222.0	4	0.02	2	
	(c) m-chlorophenol	solid	33.5	214.0	4	0.03	2	
964	Chloroprene	liquid	---	59.4	1	23.1	7	
965	Chlorosulfonic acid	liquid	-80.0	158.0	1	0.1	2,3	*
970	m-Chlorotoluene	liquid	-47.8	162.0	1	0.4	2,3	
980	o-Chlorotoluene	liquid	-35.1	159.2	1	0.3	2,3	
990	p-Chlorotoluene	liquid	7.5	162.0	1	0.4	2,3	
992	Chlorotrifluoromethane	gas	---	-81.4	5	---	---	
1000	m-Cresol	liquid	11.5	202.2	1	0.01	2	*

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
1010	o-cresol	solid	30.9	191.0	1	0.04	7	*
1020	p-cresol	solid	34.8	201.9	1	0.01	7	*
1021	Mixed Cresols (see above)							
1030	Cresylic acids	liquid	---	200.0	4	<0.01	10	
1040	Crotonaldehyde	liquid	-76.5	104.0	4	4.0	5	
1050	trans-crotonic acid	solid	71.6	185.0	4	0.03	2,3	*
1060	Cumene	liquid	-96.0	152.4	1	0.4	2,3	
1070	Cumene hydroperoxide	liquid	NA	153	16	NA		
1080	Cyanoacetic acid	solid	66.0	108.0	4	2.9	10	
1090	Cyanogen chloride	gas	---	13.8	4	--	--	
1100	Cyanuric acid	solid	>360	---	15	NA		
1110	Cyanuric chloride	solid	146.0	194.0	5	0.05	10	
1120	Cyclohexane	liquid	6.5	80.7	4	10.6	2,3	
1130	Cyclohexanol	liquid	24.0	161.0	4	0.1	2,3	
1140	Cyclohexanone	liquid	-32.1	155.6	4	0.5	2,3	
1150	Cyclohexene	liquid	-103.5	83.0	4	9.4	7	
1106	Cyclohexylamine	liquid	-17.7	134.5	4	0.8	7	*
1170	Cyclooctadiene (1,5-)	liquid	-69.5	150.8	1	3.3	5	
1180	Decanol	liquid	7	232.9	15	<0.01	2	*
1190	Diacetone alcohol	liquid	-44.0	167.9	4	0.1	2,3	*
1200	Diaminobenzoic acid	liquid	200	---	7	NA		
1210	Dichloroaniline							

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
	(a) 2,3-dichloroaniline	solid	24.0	252.0	1	<0.01	10	
	(b) 2,4-dichloroaniline	solid	63.5	245.0	1	<0.01	10	
	(c) 2,5-dichloroaniline	solid	50.0	251.0	1	<0.01	10	
	(d) 3,4-dichloroaniline	solid	72.0	272.0	1	<0.01	10	
	(e) 3,5-dichloroaniline	solid	52.0	260.0	1	<0.01	10	
1215	m-dichlorobenzene	liquid	-24.8	173.0	4	0.2	17	
1216	o-dichlorobenzene	liquid	-17.0	180.5	4	0.2	7	*
1220	p-dichlorobenzene	solid	53	174	15	0.1	2	*
1221	Dichlorodifluoromethane	gas	-35.4	-29.8	5	---	---	
1244	1,2-dichloroethane (EDC)	liquid	-35.3	83.5	1	8.2	7	
1240	Dichloroethyl ether (sym)	liquid	-50.0	178.0	4	0.1	2,3	*
1250	Dichlorohydrin (α)	liquid	-4.0	174.3	4	0.1	2,3	*
1270	Dichloropropene							
	(a) 1,1-dichloropropene	liquid	---	76.5	1	12.1	10	
	(b) 1,2-dichloropropene	liquid	---	77.0	1	12.1	10	
	(c) 1,3-(cis)dichloropropene	liquid	---	104.3	1	4.0	10	
	(d) 1,3 (trans)dichloropropene	liquid	---	112.0	1	2.9	10	
	(e) 2,3-dichloropropene	liquid	---	94.0	1	6.0	10	
	(f) 3,3-dichloropropene	liquid	---	84.4	1	9.4	10	
1280	Dicyclohexylamine	liquid	20.0	255.8	4	<0.01	10	
1290	Diethylamine	liquid	-50.0	55.5	4	24.0	2,3	
1300	Diethylene glycol	liquid	-6.5	244.5	4	<0.01	2,5	*

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
1304	Diethylene glycol diethyl ether	liquid	---	189.0	1	<0.01	10	
1305	Diethylene glycol dimethyl ether	liquid	-68.0	162.0	4	0.3	2	
1310	Diethylene glycol monobutyl ether	liquid	-68.1	231.0	1	<0.01	5	
1320	Diethylene glycol monobutyl ether acetate	liquid	-32.0	245.0	1	<0.01	5	
1330	Diethylene glycol monoethyl ether	liquid	---	195.0	1	0.02	2,3	*
1340	Diethylene glycol monoethyl ether acetate	liquid	-25.0	218.0	1	0.01	5	
1360	Diethylene glycol monomethyl ether	liquid	---	193.0	1	<0.13	18	
1420	Diethyl sulfate	liquid	-25.0	209.5	4	0.03	5	
1430	Difluoroethane	gas	---	57.6	5	---	---	
1440	Diisobutylene							
	(a) 2,4,4-trimethyl-1-pentene	liquid	-93.5	101.4	1	4.6	7	
	(b) 2,4,4-trimethyl-2-pentene	liquid	-106.3	104.9	1	3.7	7	
1442	Diisodecyl phthalate	liquid	-50.0	253.5	5	<0.01	19	*
1444	Diisooctyl phthalate	liquid	---	370.0	5	<0.01	19	*
1450	Diketene	liquid	-7.5	122.4	5	1.6	10	
1460	Dimethylamine	gas	---	6.9	5	---	---	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
1470	N,N-dimethyl aniline	liquid	2.5	194.2	1	0.1	2,3	*
1480	Dimethyl ether	gas	---	-24.5	5	---	---	
1490	N,N-dimethyl formamide	liquid	-61.0	153.0	4	0.4	7	*
1495	Dimethylhydrazine							
	(a) 1,1-dimethylhydrazine	liquid	---	63.0	1	16.4	7	
	(b) 1,2-dimethylhydrazine	liquid	---	81.0	1	7.1	7	
1500	Dimethyl sulfate	liquid	-27.0	188.0	4	0.09	10	
1510	Dimethyl sulfide	liquid	-98.3	37.3	1	48.8	2,3	
1520	Dimethyl sulfoxide	liquid	13.5	189.0	4	0.1	7	
1530	Dimethyl terephthalate	solid	140.0	300 subl.	5	<0.01	10	
1540	3,5-dinitrobenzoic acid	solid	206.0	---	4	NA		
1545	Dinitrophenol	solid	115	---	15	NA		
1550	Dinitrotoluene							
	(a) 2,4-dinitrotoluene	solid	71.0	300.0	1	<0.01	7	*
	(b) 2,6-dinitrotoluene	solid	66.0	---	1	<0.01	7	*
	(c) 3,5-dinitrotoluene	solid	93.0	subl.	1	<0.01	7	*
1560	Dioxane	liquid	11.8	101.1	4	4.2	2,3	
1570	Dioxolane	liquid	-95.0	78.0	1	9.3	5	
1580	Diphenylamine	solid	53.5	302.0	4	<0.01	2	*
1590	Diphenyl oxide	solid	27.0	259.0	5	0.01	2	*

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
1600	Diphenyl thiourea (sym)	solid	154.0	---	4	NA		
1610	Dipropylene glycol	liquid	---	230.5	1	<0.01	5	
1620	Dodecene	liquid	-35.2	213.4	1	0.03	2	*
1630	Dodecylaniline	liquid	---	245.0	5	NA		
1640	Dodecylphenol	liquid	---	322.5	5	<0.01	10	
1650	Epichlorohydrin	liquid	-25.6	117.9	4	1.7	5	
1660	Ethanol	liquid	-117.3	78.5	1	5.7	2,3,5,11	
1661	Ethanolamine	liquid	10.3	170.8	4	0.1	5	
1670	Ethyl acetate	liquid	83.0	77.0	4	9.7	2,3,5	
1680	Ethyl acetoacetate	liquid	-45.0	180.8	4	0.1	2,3,5	
1690	Ethyl acrylate	liquid	<-72.0	99.4	4	3.7	2,3	
1700	Ethylamine	gas	---	16.6	5	---	---	
1710	Ethylbenzene	liquid	-95.0	136.3	4	1.0	2,3	
1720	Ethyl bromide	liquid	-119.0	38.2	4	42.2	2,3,5	
1730	Ethyl cellulose	solid	---	---	5	NA		
1740	Ethyl chloride	gas	---	12.5	4	---	---	
1750	Ethyl chloroacetate	liquid	-26.0	145.0	4	0.5	2,3	
1760	Ethyl cyanoacetate	liquid	-22.0	206.0	4	<0.01	2	*
1770	Ethylene	gas	---	-103.9	5	---	---	
1780	Ethylene carbonate	solid	36.4	248.0	5	<0.01	10	
1790	Ethylene chlorohydrin	liquid	-67.0	129.0	4	0.7	5	
1800	Ethylenediamine	liquid	8.5	116.5	4	1.4	2,3,5	
1810	Ethylene dibromide	liquid	9.8	131.4	1	1.5	2,3	
1830	Ethylene glycol	liquid	-13.0	197.6	4	0.01	2,3	*

OCPDB ID. NO	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
1840	Ethylene glycol diacetate	liquid	-31.0	190.0	1	0.04	2,5	
1870	Ethylene glycoldimethyl ether	liquid	-58.0	83.5	1	7.8	2,3	
1890	Ethylene glycolmonobutyl ether	liquid	---	171.5	4	0.1	5	
1900	Ethylene glycol monobutyl ether acetate	liquid	-63.5	192.3	5	0.05	10	
1910	Ethylene glycol monoethyl ether	liquid	-70.0	135.0	4	0.6	7	*
1920	Ethylene glycol monoethyl ether acetate	liquid	-61.7	156.0	4	0.3	5	*
1930	Ethylene glycol monomethyl ether	liquid	-85.1	124.0	4	1.2	2,3	
1940	Ethylene glycol monomethyl ether acetate	liquid	-70.0	143.0	4	0.3	5	
1960	Ethylene glycol monophenyl ether	liquid	14.0	245.2	4	<0.01	2,3,5	
1970	Ethylene glycol monopropyl ether	liquid	---	150	9	0.5	10	
1980	Ethylene oxide	gas	---	10.7	5	---	---	
1990	Ethyl ether	liquid	-116.3	34.6	4	58.9	2,3,5	
2000	2-ethylhexanol	liquid	<-76.0	185.0	1	0.01	17	
2010	Ethyl orthoformate	liquid	<-18.0	146.0	4	0.4	2	
2020	Ethyl oxalate	liquid	-40.6	186.0	5	0.02	2	*
2030	Ethyl sodium oxalacetate	solid	---	---	5	NA		

OCPDB ID NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
2040	Formaldehyde	gas	-92	-19.5	4	---	--	
2050	Formamide	liquid	2.6	210.5	4	<0.01	2	*
2060	Formic acid	liquid	8.4	100.5	4	3.4	2,3	
2070	Fumaric acid	solid	301.0	165 (subl.)	1	0.08	10	
2073	Furfural	liquid	-38.7	161.7	4	0.2	2,3	
2090	Glycerol	liquid	17.8	290.0	4	<0.01	2,7	*
2091	Glycerol dichlorohydrin	liquid	-4.0	174.3	4	0.9	5	
2100	Glycerol triether (Glycerol tri(polyoxypropylene)ether)	NA	---	---		NA		
2110	Glycine	solid	262.0	---	1	NA		
2120	Glyoxal	liquid	15.0	51.0	1	NA		
2145	Hexachlorobenzene	solid	231.0	324.5	4	<0.01	2	*
2150	Hexachloroethane	solid	187.1	186.0 (subl.)	4	0.1	2,3	*
2160	Hexadecyl alcohol	liquid	49.0	344.0	4	<0.01	2	*
2165	Hexamethylenediamine	solid	42.0	205.0	4	0.03	10	
2170	Hexamethyleneglycol	solid	42.8	208.0	4	0.02	10	
2180	Hexamethylene tetramine	solid	263.0	---	4	NA		
2190	Hydrogen cyanide	liquid	-13.4	25.6	4	66.6	2,3	
2200	Hydroquinone	solid	170.5	286.0	4	<0.01	2	*
2210	p-Hydroxybenzoic acid	solid	215.0	---	1	NA		
2240	Isoamylene							
	a) α-isoamylene (3-methyl-1-butene)	gas	---	20.0	1	---	-	
	b) β-isoamylene	liquid	-133.8	38.6	1	51.2	2	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
2250	Isobutanol	liquid	-180.0	108.0	4	1.0	7	
2260	Isobutyl acetate	liquid	-99.0	118.0	4	1.9	2,3	
2261	Isobutylene	gas	---	-6.9	4	---	--	
2270	Isobutylaldehyde	liquid	-65.9	64.0	4	18.3	7	
2280	Isobutyric acid	liquid	-47.0	153.5	4	0.2	2,3	
2300	Isodecanol	liquid	---	220.0	5	<0.01	19	
2320	Isooctyl alcohol	liquid	---	188.5	1	<0.01	19	
2321	Isopentane	liquid	-159.9	27.9	1	76.5	7	
2330	Isophorone	liquid	-8.1	215.2	5	0.03	2,5	
2340	Isophthalic acid	solid	348	subl.	1	<0.01	10	
2350	Isoprene	liquid	-145.9	34.1	4	53.1	2,3	
2360	Isopropanol	liquid	-88.5	82.5	4	4.4	2,3,5	
2370	Isopropyl acetate	liquid	-73.4	90.0	1	6.1	2,3	
2380	Isopropylamine	liquid	-101.0	33.5	4	29.3	2	
2390	Isopropyl chloride	liquid	-117.0	35.5	4	59.3	2,3	
2400	Isopropyl phenol							
	a) o-isopropylphenol	liquid	15.5	213.5	1	0.01	2	*
	b) m-isopropylphenol	solid	26.0	228.0	1	0.01	2	*
	c) p-isopropylphenol	solid	62.5	229.0	1	0.01	1	*
2410	Ketene	gas	---	-56.0	5	---	--	
2414	Linear alkyl sulfonate	solid	---	---	5	NA		
2417	Linear alkylbenzene (n-dodecylbenzene)	liquid	3.0	331	8	<0.01	10	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
2420	Maleic acid	solid	139.5	---	1	NA		
2430	Maleic anhydride	solid	60.0	198.0	1	0.04	2,3	*
2440	Malic acid	solid	131.5	---	4	NA		
2450	Mesityl oxide	liquid	-41.5	130.0	4	1.2	2,3,5	
2455	Metanilic acid	solid	---	---	4	NA		
2460	Methacrylic acid	liquid	16.0	163.0	4	0.1	2,3	*
2490	Methallyl chloride							
	a) α-methallyl chloride	liquid	---	64.1	4	20.4	10	
	b) β-methallyl chloride	liquid	---	71.5	4	14.7	10	
	c) γ- (cis)methallyl cl.	liquid	---	84.1	4	9.4	10	
	d) γ- (trans)methallyl cl.	liquid	---	84.8	4	9.0	10	
2500	Methanol	liquid	-93.9	65.0	1	12.3	2,3,5,11	
2510	Methyl acetate	liquid	-98.0	56.9	4	20.0	2,3	
2520	Methyl acetoacetate	liquid	-80.0	170.0	4	0.1	5	
2530	Methylamine	gas	---	-6.3	4	---	--	
2540	n-methylaniline	liquid	-57.0	195.0	4	0.05	2	*
2545	Methyl bromide	gas	---	3.6	4	---	--	
2550	Methyl butynol	liquid	3.0	104.0	1	1.5	7	*
2560	Methyl chloride	gas	---	-23.7	4	---	--	
2570	Methyl cyclohexane	liquid	-126.6	100.9	1	4.6	2,3	
2590	o-methyl cyclohexanone	liquid	-14	165.1	1,9	0.3	10	
	m-methyl cyclohexanone	liquid	---	169.6	1,9	0.2	10	
	p-methyl cyclohexanone	liquid	---	171.3	1,9	0.2	10	
2620	Methylene chloride	liquid	-95.1	40.0	1	46.1	2,3	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
2630	Methylene dianiline	solid	91.8	398.5	4	NA		
2635	Methylene diphenyl diisocyanate	solid	37.0	---	5	NA		
2640	Methyl ethyl ketone	liquid	-86.0	79.6	4	10.2	2,3	
2645	Methyl formate	liquid	-100.0	31.5	4	54.8	2,3	
2650	Methyl isobutyl carbinol	liquid	-90.0	131.8	5	0.4	5	
2660	Methyl isobutyl ketone	liquid	-84.7	117.5	4	2.1	5	
2665	Methyl methacrylate	liquid	-48.2	101.0	5	3.8	2,3	
2670	Methyl pentynol	liquid	-30.6	121.5	4	0.7	10	
2690	α-Methyl styrene	liquid	24.5	163.4	1	0.3	2,3	
2700	Morpholine	liquid	-4.9	128.9	4	0.9	5,7	
2710	1-naphthalene sulfonic acid	solid	90.0	---	4	NA		
2720	2-naphthalene sulfonic acid	solid	124.5	---	4	NA		
2730	1-naphthol	solid	96.0	288.0	4	<0.01	2	*
2740	2-naphthol	solid	122.0	285.0	4	<0.01	2	*
2750	Neopentanoic acid	solid	35.4	163.7	1	NA		
2756	o-nitroaniline	solid	71.5	289.0	1	<0.01	2	*
2757	p-nitroaniline	solid	149.0	331.7	1	<0.01	2	*
2760	o-nitroanisole	liquid	9.4	277.0	4	<0.01	10	
2762	p-nitroanisole	solid	54.0	260.0	4	<0.01	10	
2770	Nitrobenzene	liquid	6.0	210.5	4	0.03	2,3	*

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
2780	Nitrobenzoic acid							
	a) o-nitrobenzoic acid	solid	147.5	---	4	NA		
	b) m-nitrobenzoic acid	solid	142.0	---	4	NA		
	c) p-nitrobenzoic acid	solid	242.4	---	4	NA		
2790	Nitroethane	liquid	-50.0	114.5	4	2.1	2,3,5	
2791	Nitromethane	liquid	-17.0	100.8	4	3.7	2,3,5	
2792	Nitrophenol							
	a) m-nitrophenol	solid	47.0	194.0	4	0.1	6	*
	b) o-nitrophenol	solid	45.5	216.0	4	0.03	2	*
	c) p-nitrophenol	solid	115.3	279.0	4	0.1	6	*
2795	Nitropropane							
	a) 1-nitropropane	liquid	-108.0	131.6	4	1.0	2,3,5	
	b) 2-nitropropane	liquid	-93.0	120.3	4	1.7	2,3,5	*
2800	Nitrotoluene							
	a) m-nitrotoluene	liquid	15.5	231.9	4	0.03	2	*
	b) o-nitrotoluene	liquid	-10.0	222.0	4	0.03	2	*
	c) p-nitrotoluene	solid	53.5	238.0	4	0.01	2	*
2810	Nonene	liquid	---	149.9	5	0.5	7	*
2820	Nonyl phenol	liquid	-10.0	315.0	5	<0.01	10	
2830	Octyl phenol	solid	73.0	291.0	5	<0.01	2	*
2840	Paraldehyde	liquid	12.0	124.0	4	3.4	5	
2850	Pentaerythritol	solid	260.0	---	4	NA		
2851	n-pentane	liquid	-129.7	36.1	4	50.0	2,3	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
2855	a) 1-pentene	liquid	-138	30.0	1	74.8	2	
	b) 2-pentene	liquid	-151.4	36.9	1	(cis)54.3 (trans)55.5	7	
2860	Perchloroethylene	liquid	-22.0	121	4	1.8	2,3	
2882	Perchloromethyl mercaptan	liquid	-	148.5	5	0.6	10	
2890	o-phenetidine	liquid	-20.0	229.0	4	<0.01	2	*
2900	p-phenetidine	liquid	3.0	254.0	4	0.1	6	*
2910	Phenol	solid	43.0	181.8	1	0.1	2,3	*
2920	Phenolsulfonic acid	solid	94.5	---	4	NA		
2930	Phenylanthranilic acid	solid	183.5	---	4	NA		
2940	Phenylenediamine							
	a) m-phenylenediamine	solid	62.5	285.5	4	<0.01	2	*
	b) o-phenylenediamine	solid	103.5	257.0	4	1.18	20	
	c) p-phenylenediamine	solid	146.0	267.0	4	<0.01	10	
2950	Phosgene	gas	---	8.2	5	---	---	
2960	Phthalic anhydride	solid	130.8	295.0	4	<0.01	2	*
2970	Phthalimide	solid	238.0	---	1	NA		
2973	a) β-picoline	liquid	-18.3	144.1	1	0.6	7	
	b) α-picoline	liquid	3.6	144.9	1	1.0	2	
2976	Piperazine	solid	106.0	146.0	1	NA		
3000	Polybutenes	solid	---	---	5	NA		
3010	Polyethylene glycol	liquid			4	<0.01	19	
3025	Polypropylene glycol	liquid	---	---	4	<0.01	5,19	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
3063	Propionaldehyde	liquid	-81.0	49.0	1	34.1	14	
3066	Propionic acid	liquid	-21.5	141.1	1	0.3	2,3	
3070	n-propyl alcohol	liquid	-127.0	97.2	4	2.0	2,3	
3075	Propylamine	liquid	-83.0	48.5	4	33.0	2,3,5,14	
3080	Propyl chloride	liquid	-122.5	46.5	4	37.3	14	
3090	Propylene	gas	---	-48.0	4	---	---	
3100	Propylene chlorohydrin	liquid	---	135.5	1	0.7	5	
3110	Propylene dichloride	liquid	-70.0	95.5	4	5.3	2	
3111	1,2-propylene glycol	liquid	-59.0	188.2	4	0.01	5	
3120	Propylene oxide	liquid	-112.1	34.2	4	59.4	2,3,5	
3130	Pyridine	liquid	-42.0	115.5	4	1.7	2,3	
3140	Quinone	solid	115.7	subl.	4	5.0	6	*
3150	Resorcinol	solid	110.0	280.0	4	<0.01	2	*
3160	Resorcylic acid	solid	239.0	---	1	NA		
3170	Salicylic acid	solid	159.0	subl.	1	<0.01	2	*
3180	Sodium acetate	solid	58.0	---	4	NA		
3181	Sodium benzoate	solid	300.0	---	9	NA		
3190	Sodium carboxymethyl cellulose	solid	---	---	5	NA		
3191	Sodium chloroacetate	solid	---	---	5	NA		
3200	Sodium formate	solid	253.0	---	4	NA		
3210	Sodium phenate	solid	---	---	5	NA		
3220	Sorbic acid	solid	134.5	228.0	4	<0.01	10	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
3230	Styrene	liquid	-30.6	145.5	4	0.7	2,3	
3240	Succinic acid	solid	186.0	235.0	4	<0.01	10	
3250	Succinitrile	solid	57.2	266.0	4	<0.01	10	
3251	Sulfanilic acid	solid	288.0	---	4	NA		
3260	Sulfolane	solid	27.6	285.0	4	<0.01	10	
3270	Tannic acid	solid	212.5	---	4	NA		
3280	Terephthalic acid	solid	300.0	---	4	0.02	6	*
3290	1,1,2,2-tetrachloroethane	liquid	-44.0	146.5	4	0.6	2	
3300	Tetrachlorophthalic anhydride	solid	255.5	subl.	1	NA		
3310	Tetraethyllead	liquid	136.5	200.0	1	0.04	2,3	
3320	Tetrahydronaphthalene	liquid	-35.8	207.4	1	0.04	2,7	
3330	Tetrahydrophthalic anhydride	solid	74.0	---	1	NA		
3335	Tetramethyllead	liquid	-27.5	110.0	1	3.0	2	
3340	Tetramethylenediamine	solid	27.0	158.5	5	NA		
3341	Tetramethylethylenediamine	liquid	-55.1	121.5	5	NA		
3349	Toluene	liquid	-95.0	110.6	4	2.8	2,3,11	
3350	Toluene-2,4-diamine	solid	99.0	292.0	4	<0.01	2	*
3354	Toluene-2,4-diisocyanate	liquid	20.0	251.0	4	<0.01	5	
3355	Toluene-diisocyanates (mixture)	liquid	---	---	5	<0.01	21	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
3360	Toluene sulfonamide							
	a) o-toluene sulfonamide	solid	156.1	---	1	NA		
	b) p-toluene sulfonamide	solid	138.8	---	1	NA		
3370	Toluene sulfonic acids							
	a) o-toluene sulfonic acid	solid	67.5	128.0	1	0.9	10	
	b) p-toluene sulfonic acid	solid	104.5	140.0	1	0.4	10	
3380	Toluene sulfonyl chloride							
	a) o-toluene sulfonyl chloride	liquid	10.2	154.0	1	0.5	10	
	b) p-toluene sulfonyl chloride	solid	71.0	145.5	1	0.7	10	
3381	Toluidines							
	a) m-toluidine	liquid	-30.4	203.4	1	0.03	2	*
	b) o-toluidine	liquid	-14.7	200.2	1	0.03	2	*
	c) p-toluidine	solid	43.7	200.6	1	0.03	2,3	*
	Trichlorobenzenes							
3390	a) 1,2,3-trichlorobenzene	solid	53.5	218.5	1	0.04	2	*
3391	b) 1,2,4 trichlorobenzene	liquid	17.0	213.5	1	0.04	2	*
3393	c) 1,3,5-trichlorobenzene	solid	63.4	208.4	4	NA		
3395	1,1,1-trichloroethane	liquid	-32.5	74.1	4	12.8	2,3	
3400	1,1,2-trichloroethane	liquid	-35.0	113.5	4	2.7	2,3,5	
3410	Trichloroethylene	liquid	-84.8	86.7	4	7.7	2,3	
3411	Trichlorofluoromethane	liquid	-111.0	23.7	4	79.5	2,3	
3420	1,2,3-trichloropropane	liquid	-14.7	156.9	4	0.3	2,3	
3430	1,1,2-trichloro-1,2,2-trifluoroethane	liquid	-35.0	47.6	5	31.8	2,3	

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
3450	Triethylamine	liquid	-115.0	89.5	4	7.2	17	
3460	Triethylene glycol	liquid	-5.0	278.3	1	<0.01	5	
3470	Triethylene glycol dimethyl ether	liquid	-45.0	216.0	4	0.02	10	
3480	Triisobutylene	liquid	---	351.0	5	0.2	2,3	
3490	Trimethylamine	gas	---	-4.0	5	---	---	
3500	Urea	solid	132.7	---	4	NA		
3510	Vinyl acetate	liquid	-93.2	72.2	1	11.3	2,3	
3520	Vinyl chloride	gas	---	-14.0	4	---	2,3	
3530	Vinylidene chloride	liquid	-122.5	31.7	4	68.6	2,3	
3540	Vinyl toluene	liquid	-76.8	170.5	5	0.2	2,3	
3541	m-xylene	liquid	-47.4	139.3	4	0.8	14,20	
3560	o-xylene	liquid	-25.0	144.0	4	0.7	2,11	
3570	p-xylene	liquid	13.5	137.5	4	0.9	2,3	
3580	Xylenol							
	a) 2,3-xylenol	solid	75.0	218.0	4	0.01	2	*
	b) 2,4-xylenol	solid	25.7	211.5	4	0.01	2	*
	c) 2,6-xylenol	solid	49.0	203.0	4	0.02	14	
	d) 2,5-xylenol	solid	74.5	211.5	4	0.01	2	*
	e) 3,4-xylenol	solid	62.5	225.0	4	0.01	2	*
	f) 3,5-xylenol	solid	64.0	219.5	4	0.01	2	*

OCPDB ID. NO.	COMPOUND NAME	PHYSICAL STATE	MELTING POINT °C	BOILING POINT °C	(A) REFERENCES	VAPOR PRESSURE (kPa at 20 °C)	(B) REFERENCES	CODE
3590	Xylidene							
	a) 2,3-xylidene	liquid	<-15.0	221.5	1	0.01	10	
	b) 2,4-xylidene	liquid	16.0	214.0	1	0.01	2	*
	c) 2,5-xylidene	liquid	15.5	214.0	1	0.02	10	
	d) 2,6-xylidene	liquid	11.2	214.0	1	0.03	2	*

The OCPDB ID Numbers are reference indices assigned to the various chemicals in the Organic Chemical Producers Data Base developed by EPA.

Code: * - 20°C is not within the temperature range specified in the reference.

Physical State: given at 20°C and 101.3 kPa (1 atmosphere).

References: (A) physical state, melting point, boiling point
(B) vapor pressure

NA: not available in the references listed.